AMENDED BY ART 34 AMDT

I claim:

1. Apparatus for making a glass preform by flame hydrolysis, comprising:

a housing that defines a deposition chamber;

a support mandrel mounted within the deposition chamber, for rotation about a longitudinal axis; and

a main deposition burner configured to direct two or more streams of soot-forming reactants and a stream of flame gases toward the support mandrel, so as to form by flame hydrolysis a glass preform on the mandrel, wherein the burner is configured to direct two of the streams of soot-forming reactants to impinge quasi-tangentially on the glass preform, on opposite sides of the longitudinal axis, to reduce turbulence in the streams at the site of the preform.

2. Apparatus as defined in claim 1, and further comprising:

one or more auxiliary burners configured to introduce one or more streams of flame gases, but no stream of soot-forming reactants, toward the glass preform, to heat portions of the preform not fully heated by the stream of flame gases directed by the main deposition burner; and

a controller configured to controllably operate the one or more auxiliary burners after the glass preform formed on the support mandrel has reached a predetermined size.

3. Apparatus as defined in claim 2, wherein the apparatus comprises one or more pairs of auxiliary burners, located on opposite sides of the main deposition burner and spaced circumferentially around the support mandrel.

4. Apparatus as defined in claim 1, and further comprising a mount configured to withdraw the main deposition burner from the glass preform as

the preform grows in size, to reduce turbulence in the one or more streams of soot-forming reactants at the site of the preform.

5. Apparatus as defined in claim 1, wherein the main deposition burner has a central axis and comprises:

a reactant port, aligned with the central axis, for forming the one or more streams of soot-forming reactants; and

a plurality of flame ports, arranged concentrically around the reactant port, for forming the flame concentrically around the one or more streams of soot-forming reactants.

6. Apparatus as defined in claim 5, wherein the main deposition burner further comprises a first plurality of shield gas ports, arranged concentrically around the reactant port, between the reactant port and the plurality of flame ports, for forming an inner shield gas stream between the two or more streams of soot-forming reactants and the flame.

7. Apparatus as defined in claim 6, wherein the main deposition burner further comprises a second plurality of shield gas ports, arranged concentrically around the reactant port, radially outward of the plurality of flame ports, for forming an outer shield gas stream radially outward of the flame.

8. Apparatus as defined in claim 5, wherein the plurality of flame ports are configured to direct the flame obliquely inwardly toward the main deposition burner's central axis.

9. Apparatus as defined in claim 8, wherein the plurality of flame ports are asymmetrically configured, such that the flame is oriented obliquely inwardly toward the main deposition burner's central axis along one transverse axis,

but is oriented substantially parallel with such central axis along an orthogonal transverse axis.

10. Apparatus as defined in claim 1, wherein the main deposition burner has a central axis and comprises:

a central reactant port, aligned with the central axis, for forming a central stream of soot-forming reactants that impinges substantially radially on the glass preform being formed on the support mandrel;

a pair of supplemental reactant ports located on opposite sides of the central reactant port, for forming supplemental streams of soot-forming reactants that impinge quasi-tangentially on the glass preform; and

a plurality of flame ports, arranged concentrically around the reactant ports, for forming the flame concentrically around the streams of soot-forming reactants.

11. Apparatus as defined in claim 10, and further comprising a valve that controls the delivery of reactant gases to the central port and to the pair of supplemental ports according to the size of the glass preform being formed on the support mandrel.

12. Apparatus as defined in claim 1, wherein the main deposition burner is configured to burn a mixture of oxygen and natural gas.

13. Apparatus as defined in claim 1, wherein the main deposition burner is configured to burn a mixture of oxygen and hydrogen.

14. Apparatus for making a glass preform by flame hydrolysis, comprising:

a housing that defines a deposition chamber;

a support mandrel mounted within the deposition chamber, for rotation about a longitudinal axis;

a main deposition burner configured to direct one or more streams of soot-forming reactants and one or more streams of flame gases toward the support mandrel, so as to form by flame hydrolysis a glass preform on the mandrel;

one or more auxiliary burners configured to introduce one or more streams of flame gases, but no stream of soot-forming reactants, toward the glass preform, to heat portions of the preform not fully heated by the stream of flame gases directed by the main deposition burner; and

a controller configured to controllably operate the one or more auxiliary burners after the glass preform formed on the support mandrel has reached a predetermined size.

15. Apparatus as defined in claim 14, wherein the main deposition burner is configured to direct one or more streams of soot-forming reactants quasi-tangentially toward the glass preform being formed on the support mandrel, to reduce turbulence in the streams at the site of the preform.

16. A deposition burner suitable for use in an apparatus for making a glass preform by flame hydrolysis, comprising:

a central reactant port that forms a central stream of soot-forming reactants that follows a central axis;

a pair of supplemental reactant ports located on opposite sides of the central reactant port, for forming supplemental streams of soot-forming reactants that diverge from the central axis; and

a plurality of flame ports, arranged concentrically around the reactant ports, for forming a flame concentrically around the streams of soot-forming reactants.

17. A deposition burner as defined in claim 16, and further comprising a first plurality of shield gas ports, arranged concentrically around the reactant port, between the reactant port and the plurality of flame ports, for forming an inner shield gas stream between the of soot-forming reactants and the flame.

18. A deposition burner as defined in claim 17, and further comprising a second plurality of shield gas ports, arranged concentrically around the reactant port, radially outward of the plurality of flame ports, for forming an outer shield gas stream radially outward of the flame.

19. A deposition burner as defined in claim 16, wherein the plurality of flame ports are configured to direct the flame obliquely inwardly toward the central axis.

20. A deposition burner as defined in claim 18, wherein the plurality of flame ports are asymmetrically configured, such that the flame is oriented obliquely inwardly toward the main deposition burner's central axis along one transverse axis, but is oriented substantially parallel with such central axis along an orthogonal transverse axis.

21. A deposition burner as defined in claim 20, and further comprising a valve that controls the delivery of reactants to the central port and to the pair of supplemental ports according to the size of the glass preform being formed.

22. A deposition burner as defined in claim 16, wherein the burner is configured to burn a mixture of oxygen and natural gas.

23. A deposition burner as defined in claim 16, wherein the burner is configured to burn a mixture of oxygen and hydrogen.